

The relationship between the constructs of the health belief model and
hearing protection use among Christchurch construction workers in
occupational and non-occupational settings

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Abstract

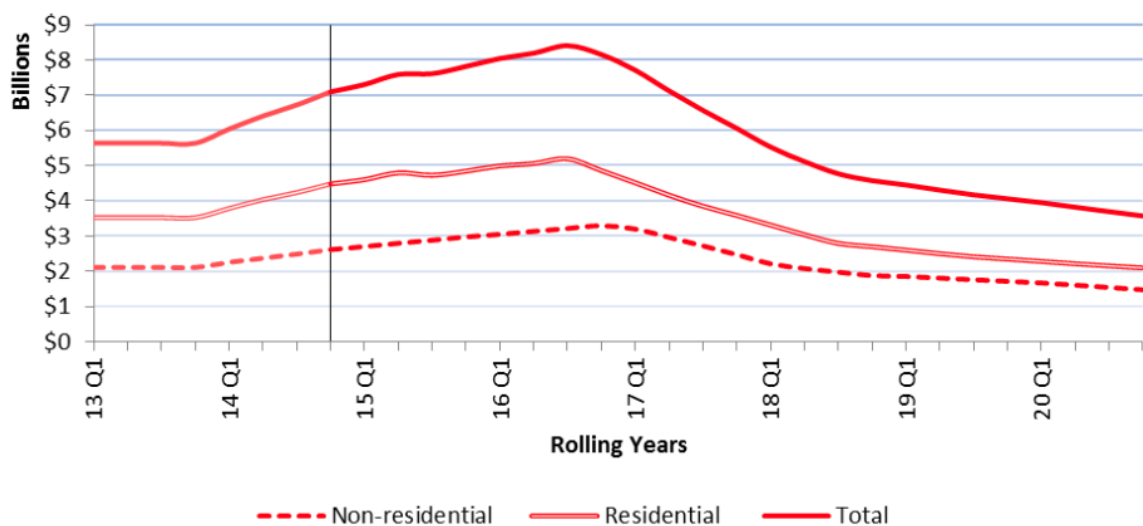
Results of previous studies suggest that the constructs of the Health Belief Model (HBM) can be used to predict health behaviours. This study examined the relationship between constructs of the HBM and hearing protection device (HPD) use among Christchurch tradespeople, in occupational and non-occupational settings. Sixty-four tradespeople were surveyed using a hearing beliefs questionnaire (HBQ), which was adapted for hearing protection use. Forty-four participants met the inclusion criteria for this study, as they spent three or more hours exposed to noise during their typical working day. The data in this current research was collected using an adapted version of the HBQ used to investigate the relationship between the constructs of the HBM and hearing aid use among veterans in the United States. A factor analysis was performed to group adapted items of HBQ within the constructs of the HBM. Correlations between constructs of the HBM and HPD use were analysed using one-tailed Pearson's correlation coefficient. No significant correlations between constructs of the HBM and HPD use among tradespeople were found. Significant correlations between six individual items used in the adapted HBQ and HPD use among tradespeople in occupational and non-occupational settings were found. These findings indicate that the adapted HBQ cannot be used to predict HPD use among tradespeople in Christchurch. Further research is required to determine robust predictors of HPD use among Tradespeople in Christchurch, which may in turn be utilised to reduce noise-induced hearing loss in this population.

Chapter 1: Literature Review

1.1 Introduction

Christchurch experienced two large earthquakes within a six-month period. On the 4th of September 2010 Christchurch was hit by a magnitude 7.1 earthquake which caused damage to the cities antistructure. On the 22nd of February 2011, Christchurch was hit again, by a 6.3 magnitude earthquake (McSaveney, 2017), which killed 185 people, destroyed homes, buildings and infrastructure. As a result, the construction industry in Christchurch grew significantly (City Metric, 2014; Gillies, 2014; Smith, 2014; Steeman, 2014) where about a quarter of the total growth in employment to March 2018 is forecasted to occur in the construction industry (Immigration NZ, 2016) and skill shortages in construction are being met by an influx of migrants (Immigration NZ, 2016; Steeman, 2014).

A figure from The National Construction Pipeline Report (2015) illustrates the predicted value of all building and construction for Canterbury, which shows a peak in 2016.



Source: BRANZ/Pacifecon

Figure 1. Construction in Canterbury.

Note: sourced from The National Construction Pipeline Report (2015) which was prepared by BRANZ/Pacifecon.

The New Zealand Ministry of Business, Innovation and Employment (2017) recently reported that a total 85,366 people are employed in construction-related occupations in the Canterbury, and surrounding regions.

Working around noise is linked to noise-induced hearing loss (NIHL), the result of sustained exposure to high-intensity sound causing damage to the organ of hearing, or cochlea. NIHL is reported to affect approximately 17% of New Zealanders (Reddy et al. 2012) and costs the Accident Compensation Corporation (ACC) upwards of \$50 million annually (Thorne et al., 2008). This chapter will investigate and analyse historic and recent literature surrounding hearing protection and NIHL, and health beliefs.

1.1.1 Definitions of “noise”, “occupational hearing loss”, and “non-occupational hearing loss”.

Oxford Dictionaries (2010) defines noise as - A sound, especially one that is loud or unpleasant or that causes disturbance. In previous epidemiological research surrounding exposure to noise in an occupational setting, researchers have used similar criteria for describing noise to participants. These researchers would inform participants to consider an environment to be noisy if the individual had to shout to be heard in a conversation with someone who is standing at arm's length. (McBride, 1993; Neitzel et al, 2008; John et al, 2014). A similar criterion will be used in this current study if the researcher is asked by participants to define noise.

Occupational hearing loss is any hearing loss resulting from an occupational hazard, primarily from an over exposure to noise (Masterson, 2016).

Non-occupational hearing loss can then be defined as any hearing loss acquired outside of an occupational setting. This includes a NIHL caused by noisy activities such as; woodwork,

yard maintenance, firearms, and concerts (May, 2000), it also includes any other form of hearing loss.

1.2 Noise-induced Hearing Loss

A NIHL is caused by an overexposure to noise. According to Wheeler (1950) there is sufficient evidence from research that dates back to the 1940s indicating that workers who spend sufficient amount of time exposed to high levels of noise are susceptible to the possibility of sustaining an irreversible hearing loss. This next section will review previous research surrounding NIHL.

1.2.1 Physiology of NIHL

There is sufficient evidence which shows that a NIHL is partly caused by mechanical destruction and/or deformation of the hair cells and other structures of the organ of Corti in the cochlea (Spoendlin, 1971; Hamernik, Henderson, Crossley, & Salvi, 1974; Hamernik, & Henderson, 1974; Hawkins, Johnsson, Stebbins, Moody, & Coombs, 1976; Basner, Babish, Davis, Brink, Clarck, Janssen, & Stansfeld, 2007). Increased levels of reactive oxygen species (ROS) underlie cochlear pathologies that occur as a result of an over exposure to noise (Henderson, Bielefeld, Harris, & Hu, 2006). These ROS are suggested to play a significant role in both apoptotic (biomechanical events that lead to the morphology or death of a cell) and necrotic (cellular injury resulting in trauma induced cell death) hair cell death that is noise induced (Nicotera, Henderson, Zheng, Ding, & McFadden, 1999; Campbell, 2003; Henderson et al., 2006).

1.2.2 Risk Factors

There are some factors that may cause an increased susceptibility to temporary and permanent thresholds shifts due to exposure to noise. Daniel (2007) conducted a review of the literature that was currently published regarding the modifiable and nonmodifiable risk

factors of NIHL, comorbidity, and the role of health education in the prevention of NIHL.

This study was conducted by Daniel because of the increasing amounts of young adults and children who are obtaining a temporary or permanent NIHL in the United States.

The results of the literature review (Daniel, 2007) revealed risk factors of NIHL which are unable to be modified in order to prevent or prolong NIHL. These nonmodifiable risk factors reviewed in Daniel's study (2007) include; age, race, gender, and genetics. Out of the four risk factors revealed in this literature review, age is suggested by Daniel (2007) to be the most significant nonmodifiable risk factor of NIHL. The results of the studies reviewed in Daniel's study (2007) yield evidence to suggest that the risk of obtaining a NIHL increases as an individual's age increases.

There are risk factors that relate to NIHL that, unlike the risk factors previously mentioned, are able to be modified in order to prevent, prolong, or reduce the severity of a NIHL. The modifiable risk factors that were reviewed by Daniel (2007) include; smoking (including non-smokers who are exposed to both noise and second-hand smoke), lack of physical exercise, diets that are low in antioxidant minerals and vitamins, and the non-use of hearing protection devices (HPDs).

The non-use of HPDs was the most relevant modifiable risk factor to this current study when compared to the other modifiable risk factors reviewed by Daniel (2007). Daniel (2007) reviewed studies that suggest that even though individuals may be aware of the risks involved with exposure to loud noise, there are several reasons involved that may make these individuals reluctant to wear HPDs. The reasons mentioned by Daniel (2007) include; pressure from peers, limited of knowledge about NIHL, discomfort, safety concerns, and cosmetic concerns. Further studies reviewed by Daniel (2007) suggest that individuals may not wear HPDs while exposed to excessive noise because they are unaware of the risks of

loud noise, or do not consider a hearing loss to be a major concern. One limitation the literature review conducted by Daniel (2007) was the year in which it was published. Daniel's literature review was published in 2007, and so was a decade old at the time that this current study was conducted.

The results found in a study conducted by Vittitow, Windmill, Yates, and Cunningham, (1994) suggest that being involved in physical activities while simultaneously being exposed to loud noise (96 dBA) for a period of 20 minutes may increase the temporary shift in hearing thresholds caused by the noise. These results suggest that being exposed to noise while doing a physical activity may increase the risk of a NIHL. Construction workers often perform tasks which generate excessive amounts of noise (Barkokébas, Vasconcelos, Lago, & Alcoforador, 2012). Thus, one could argue that the risk of tradespeople obtaining a NIHL is increased as a consequence of the physically intensive manual labour they are often required to perform while exposed to noise. This argument emphasises the importance of taking action to reduce the risk of a NIHL.

1.2.3 NIHL Prevalence

After presbycusis, Noise induced hearing loss (NIHL) is the second most common type of sensorineural hearing loss (SNHL) (Nelson, Nelson, Concha-Barrientos, & Fingerhut, 2005. Rabinowitz, 2000). Nelson et al. (2005) conducted a study in conjunction with the World Health Organisation (WHO) in an attempt to assess the morbidity of NIHL caused from occupational noise exposure on a global scale in the year 2000. The WHO has 191 Member States grouped into 6 geographical regions. These regions are further divided into sub-regions, depending on the mortality rates of children and adult males from any particular sub-region, which are classed from A (lowest) to E (highest). Example of this in the Americas Region (AMR) are the United States of America and Haiti. The United States of

America has a low mortality rate, and is classified as AMR-A. In contrast, Haiti has a high mortality rate and is classified as AMR-D.

Nelson et al. calculated the proportion of adults with a hearing loss, as a result of exposure to moderately-high (85-90dB) and high (> 90dB) noise levels in an occupational setting, and divided the results by sub-regions, age groups, and gender. The results of this study suggest that occupational noise attributes to an average of 16% of all adult-onset hearing loss worldwide. This percentage ranged from 7 - 21%, depending on sub-region. The results indicated that differences in "...occupational categories, economic sectors of employment, and working lifetime" (p.454) between males and females, may be the reason why males are more often exposed to occupational noise than females. The fraction of hearing loss for which noise exposure is attributable was shown to decrease with age (starting at the age group 30-44). This indicates that occupational noise exposure may have a more of an impact on hearing loss among younger individuals than among older individuals.

The results of the study also suggest that less developed regions of the world are affected more by occupational NIHL. These results then indicate that younger working males in lesser developed WHO sub-regions are the most likely to be affected by occupational NIHL. New Zealand is located in the WHO's Western Pacific Region A (WPR-A). The results of the study conducted by Nelson et al. (2005) indicate that occupational NIHL may attribute to 7% of all adult-onset hearing loss in the WPR-A. This suggests that New Zealand, similar to other developed regions with low mortality rates, may have one of the smallest percentages of occupational NIHL worldwide.

Two-hundred and sixty-six building apprentices enrolled in a 5-year-long study conducted by Neitzel, Seixas, Goldman, and Daniell (2004) surrounding hearing loss and noise exposure. The aim of this study was to investigate how much the exposure to noise in a non-occupational setting was contributing. The participants were required to complete questions at the beginning of the study and at a 1-year follow-up to determine their episodic activities (e.g. concert attendance, power tool use, firearms exposure) and the frequency at which they were engaging in these activities. Noise exposure levels for these episodic exposures were determined from the published literature. Routine activities were assessed using activity cards filled out over 530 days, along with noise dosimetry measurements made over 124 subject-days of measurement. When compared with the high levels of occupational noise found in construction, non-occupational noise exposures generally present little additional exposure for most workers. However, they may contribute significantly to overall exposure in the subset of workers who frequently participate in selected noisy activities. Because non-occupational noise exposure may add to the total amount of exposure to noise, HPD use and the hearing health beliefs of the participants in non-occupational settings are also being investigated in this current study.

1.2.4 Predictors of NIHL

Evidence from previous research, which analysed sociodemographic data, noise-related factors, types of HPDs, self-report hearing loss, and auditory-related symptoms (e.g., tinnitus, vertigo), indicates that measures of HPD use and duration of exposure to noise are significant predictors of NIHL (Pelegrin, Canuet, Rodríguez, & Morales, 2015). However, auditory related symptoms and self-reported hearing loss represent poor indicators of objective NIHL (Pelegrin et al., 2015). The theory that duration of noise exposure as a significant predictor of NIHL is backed by researchers, Leensen, Van Duivenbooden, and Dreschler (2011), who investigated predictors of NIHL among Danish construction workers.

The researchers (Leensen et al., 2011) also compared the audiometric thresholds of the construction workers who are exposed to noise at work, and a group of participants who did not work in a noisy environment. The results of this comparison revealed that overall, participants who worked in noise had greater hearing loss than the group who were not exposed to noise at work. This current study will ask include questions surrounding the duration that participants are exposed to noise in occupational and non-occupational settings. The data collected may indicate that participants of this current study who spend a majority of their time in noise at work will be more likely to have a NIHL than those who are exposed to noise for short durations of time.

1.2.5 NIHL interventions

Le Prell, Yamashita, Minami, Yamasoba, and Miller (2007) conducted a review of literature regarding interventions, including “antioxidant agents, vasodilators, NTFs, steroids, calcineurin inhibitors, caspase inhibitors, JNK inhibitors, and Src protein tyrosine kinase (Src-PTK) inhibitors” (Le Prell et al., 2007). Le Prell et al. suggest that these interventions mentioned are all, do some degree, effective in the prevention of hearing loss and hair cell death.

Researchers from the Cochrane Occupational Safety and Health Review Group conducted a systematic review with the objective of examining “the effectiveness of non-pharmaceutical interventions for preventing occupational noise exposure or occupational hearing loss compared to no intervention or alternative interventions” (Verbeek, Kateman, Morata, Dreschler, & Mischke, 2012). The researchers (Verbeek et al, 2012) found the overall quality of the 25 reviewed studies to be low to very low. These studies indicate that implementation of stricter legislation can reduce noise levels in workplaces. The results from the review show that training and the proper use of HPDs as part of a hearing loss prevention

programme (HLPP) reduce the risk of hearing loss. These results indicate the importance of effective training and use of HPDs for reducing the risk of a NIHL.

1.3 Hearing Protection Devices

1.3.1 National noise regulations

According to the New Zealand Occupational Health and Safety (NZOHS) (2003, p.1) the New Zealand Health and Safety in Employment Regulations 1995 specifies the maximum level of noise any worker may be exposed to is:

- A Noise Exposure Level, ($L_{Aeq,8h}$)(3) of 85dBA, or
- A Peak Level (L_{peak})(4) of 140 dB (Peak, unweighted)

$L_{Aeq,8h}$ of 85dBA represents “the level of daily noise exposure normalised to the average eight-hour working day. Noise level exposure must not exceed the A-weighted sound energy of 85 decibels over an eight-hour period.” (Ministry of Business, Innovation and Employment, 2013).

L_{peak} of 140 dB represents “the highest frequency unweighted (pure sound) peak sound pressure level. Any noise, even if it is for a short time, must not exceed 140dB because this can cause instantaneous hearing damage.” (Ministry of Business, Innovation and Employment, 2013).

According to the New Zealand Ministry of Business, Innovation and Employment, Hikina Whakatutiki (2013) state that employers are required by law, under the Health and Safety in Employment Act of 1995 Regulation 11, to take practical steps to minimise, isolate, or eliminate excessive amounts of noise in the work place. If the noise exceeds 85dB(A) after the employer completes the practical steps, the employees, and others who are exposed to the hazardous noise are then required, by law, to wear HPDs provided by the employer.

1.3.2 Types of HPDs

HPDs come in several different forms including; earplugs, earmuffs, communication earmuffs, and earmuff/helmet combinations. In New Zealand HPDs are classed from 1 to 5 depending on their provided level of isolation from noise (Ministry of Business, 2013). Class 1 HPDs are effective up to 90 dB(A) of equivalent noise, Class 5 HPDs are effective up to 110 dB(A) of equivalent noise. Protecting hearing from exposure to hazardous levels of noise may reduce some of the perceived negative effects that a NIHL may have on an individual. A local study by Canton and Williams (2012) examined the consequences of NIHL in two different dairy farming communities in New Zealand. A total of 74 participants (51 male, 23 female) completed the survey questionnaire pertaining to the consequences of NIHL. The most common consequence NIHL had on the participants involved in the study was social isolation as a result of communication difficulties with other people. The loss of productivity, the need to develop coping mechanisms for communication (such as lip reading), and emotional strain were also common consequences of NIHL reported by the participants. The study by Canton and Williams (2012) offers some descriptive insight into the consequences that NIHL may have on certain communities in New Zealand. However, the results of the study may not be generalizable to tradespeople in Christchurch because the participants of this study were, in some way or another, involved in the New Zealand dairy industry and not the Christchurch construction industry. The researchers report that some of the questionnaires were incomplete and few participants answered the open ended questions of the survey in depth, consequently the some of the results may only represent certain participants of Canton and William's study (2012) and may not fairly represent all of the participants. The results were analysed descriptively because of the nature of the study. Consequently, any statistical or clinical significance of the findings cannot be measured. The consequences of NIHL that

are described in studies such as the one by conducted Canton and Williams (2012) do identify another plausible reason why protection against hazardous levels of noise is needed.

1.3.3 HPD use

The use of HPDs can reduce the damage caused by over exposure to noise in any setting. A study was conducted by John, Grynevych, Welch, McBride, and Thorne (2014) surrounding the exposure to noise of workers in different economic sectors and the use of HPD among those workers. John et al, (2014) had the aim of exploring the range of noise exposure among workers across all economic sectors in New Zealand including; Agriculture, Mining, Construction, Manufacturing, Transport/Utilities, Retail, Finance/Public administration, and Services. John et al, (2014) also examined HPD use among workers in these sectors. Data from a total of 529 participants was collected. The study had no inclusion criteria and participants were nominated by participating companies based solely on their availability at the time of the study. The individual amount of noise that each participant was exposed to during work was assessed using a dosimeter that was attached to the shoulder of the participants. The results of noise exposure measurement showed that L_{Aeq} ranged from 65 to 113.3dB. Construction was the third highest economic sector with a mean L_{Aeq} of 85.9dB. The results revealed that 66.7% of the construction workers were exposed to noise levels that exceed the recommended level of 85 dB L_{Aeq} . These findings are important for this current study as they identify information surrounding HPDs in the construction sector in New Zealand. The results add to the understanding about the quantity of tradespeople in the construction sector who are exposed to noise that exceeds the NZOHS (2003, p.1) daily limits of ($L_{Aeq,8h}$) of 85dBA.

Participants of the study (John et al., 2014) were interviewed before each noise exposure measurement was taken. The participants were asked, in the interview, to honestly

describe how long they would use HPDs when in the noisy work environment. A total of 443 workers were interviewed about their HPD use. A total of 239 participants reported using HPDs to some degree. A total of 204 participants reported no HPD use, 13 of these participants were reported to have spent more than the recommended daily limit to noise exposure without the use of HPD. (The accuracy of the self-reported hearing results possibly would have varied with each economic sector. This is based on the observations made by Griffin, Neitzel, Daniell, and Seixas (2009) which indicate that individuals who work in steady background noise are more likely to self-report the use of HPDs with greater accuracy than individuals who work in fluctuating background noise. The results of the study (John et al., 2014) suggest that over half of the workers, including tradespeople, in the New Zealand construction sector spend longer than the allowed time exposed to noise, and some of these individuals are possibly not using any form of HPD at all which may put them at greater risk of a NIHL and other health issues (Passchier-Vermeer, & Passchier, 2000; Stansfeld, & Matheson, 2003) it would be imperative for employers, and employees to know that these individuals are wearing HPDs to reduce their daily exposure to noise. The study by John et al. (2014) was conducted in Auckland, this current study however, aims to examine HPD use among tradespeople in Christchurch. In doing this, it would possibly deepen the understanding of HPD use among tradespeople in another geographically specific area in New Zealand. The study also provides evidence to suggest that noise induced damage at an average exposure level around the 85 dBA level.

1.3.4 HPD training and education

Appropriate training on the use of HPDs may be necessary for individuals to receive effective protection from hazardous levels of sound, as suggested by the results of a study conducted by Nodoushan et al. (2014). Nodoushan et al. (2014) investigated the effect of face-to-face hearing protection use training. This single blinded randomised control trial

conducted involved 150 workers who were referred to an occupational medicine clinic. The participants were divided into 3 groups. The first group used HPDs with a large noise reduction rating (NRR-30) with no training. The second group used HPDs with a necessary NRR (NRR-25) with no training. The third group used HPDs with a necessary NRR (NRR-25) accompanied with face-to-face training about the effective use of HPDs. Participants who were found to have a hearing loss, either conductive or sensorineural, were excluded from this study and those with pure tone audiometry thresholds within normal limits ($<25\text{dBA}$ considered normal in this study) and had no training in the use of HPDs in the last 2 years were recruited as participants. The sound field thresholds of the participants were measured three times without HPDs. Sound field thresholds were then measured again, this time with each participant wearing the appropriate HPDs, according to their assigned group. The participants in the group with hearing protection and face-to-face training were given a 15 minute training session before their thresholds were tested while hearing protection. The other two groups of participants were tested while wearing hearing protection and did not receive any hearing protection use training. The results showed the group who wore NRR 30 hearing protectors had more attenuation across all frequencies when compared with the group who wore NRR 25 without training. This difference in attenuation levels between these two groups was shown to be statistically significant. The group who wore hearing protectors with NRR 25 and had training on the use of hearing protectors showed to have more attenuation across all frequencies when compared with the group who wore the NNR 30 hearing proctors without training. The results of this study suggest that proper training around the use of HPDs may be more effective when reducing overall individual noise exposure than just relying on the NRR of the hearing protection device.

1.3.5 Predictors of HPD use

There are many factors that can affect an individual's likelihood to use HPDs. Reddy, Welch, Thorne, & Ameratuna (2012) conducted a qualitative study with the aim of investigating the factors that may influence HPD use among manufacturing companies in New Zealand. The main method used in the study (Reddy et al., 2012) was a semi-structured interview consisting of five items, open questions which reconnoitred the participants' beliefs, behaviour, attitude, and knowledge, towards noise and HPDs, as well as investigating supports for, and barriers against HPD use. The researchers (Reddy et al., 2012) found five themes that emerged from the results of their study. The themes and sub-themes of the factors that influence HPD use among employees of manufacturing companies are as follows;

Theme 1: Perception of noise in the workplace.

1.1 – Acceptance of noise as part of work – This theme suggests that there is an acceptance that noise is part of work and work cannot be completed without making noise.

1.2 – Noise annoyance – This suggests that noise can be annoying for employees. Some of the participants reported that noise negatively affected their mood, caused stress and discomfort, negatively affected levels of attention, and even caused some of them to get headaches/migraines.

1.3 – Fear of hearing loss – Results revealed that participants were aware that high levels of noise can damage hearing, and that the damage is gradual and not instantaneous.

Theme 2: HPD use.

2.1 – Hearing preservation – Results suggested that participants were aware that the use of HPDs can aid the preservation of hearing thresholds. Some participants talked about how high levels of noise can damage your hearing if HPDs are not used.

2.2 – Work requirement – Results indicated that some participants had a similar attitude towards the use of HPDs, as they did towards working in noise. They stated that they acknowledged that, by law, they are required to wear HPDs while at work. Consequently, they wear HPDs because they are required too. Other participants had conflicting views, "It (wearing HPD's) really comes down to the own person. You cannot force it."

2.3 – Reduce noise annoyance – Results suggested that some participants would wear HPDs to relieve some of the stress and discomfort they experience from being exposed to loud noise.

Theme 3: Reluctance to use HPD.

3.1 – Bulky – Participants of this study described HPDs as “bulky” and inconvenient because they are unable to wear other safety equipment, such as safety goggles or helmets, when wearing a HPD.

3.2 – Uncomfortable – Participants reported that HPDs were uncomfortable to wear in the hot and humid conditions of the manufacturing workshops. Some participants also reported that they experience discomfort when foam insert HPDs expand inside their ear canals, consequently discouraging the participant from wearing them.

3.3 – Communication problems – The results of the study suggest that workers have problems communicating with other workers, and are unable to hear their surroundings as well when they are wearing HPDs. The results also indicate that the constant need to remove HPD in order to communicate with other workers was frustrating for some workers, and would discourage them from using HPDs.

3.4 – Quality and availability – The results suggest that participants may be reluctant to use HPD if the quality of the HPD provided by their employer is poor. The results also suggest that workers may have a HPD preference, for example, a worker prefers insert foam

HPDs to over-the-ear HPDs. If the company doesn't supply the worker with the worker's preference of HPD, the worker may be discouraged from using HPDs.

3.5 – Habits – The results suggest that some workers do not wear HPDs out of habit and those who do not regularly wear HPD may be less likely to view them as useful protective devices.

Theme 4 – Workplace influence.

4.1 – Peer mentality – Participants of the study reported that they think they look “funny” wearing HPD, and think that co-workers will make fun of them for wearing HPDs. Consequently, they are discouraged from using HPDs because they view it as a socially inappropriate behaviour.

4.2 – Peer modelling – Results from the interviews with the participants revealed that, on the other hand, some co-workers are supportive and encourage the use of HPDs in a noisy work environment.

4.3 – Self-image – The results suggest that some workers view themselves as too strong for noise to be able to damage their hearing, thus they do not wear HPDs in order to try and prove this.

4.4 – Proper enforcement of rules – The results indicate that, if employers enforce the policies surrounding HPD use in a noisy occupational setting then workers are more likely to wear HPDs.

4.5 – Training – The results suggest that some workers thought that regular training surrounding workplace hazards and the importance of wearing HPDs encouraged the use of HPDs.

Theme 5 – Value of hearing – The results from the study suggest that some workers value how hearing is an important part of life. There is an understanding among some workers that HPDs are used to protect more than just hearing. However, there are some workers who do not see noise as an issue at all, this may prove to be a barrier to HPD use in both occupational and non-occupational settings.

According to Anderson (2010), it may be possible to utilize findings of qualitative research to provide a better understanding of the nature of educational problems, offering insights into teaching and learning in a variety of contexts. The results of the study conducted by Reddy et al. (2012) could possibly be used to gain understanding about the barriers and supporters of HPD use. HPD educators could potentially use this insight when teaching manufacturing employees about the importance of HPD use. The predictors of HPD use found in the study (Reddy et al., 2012) may be relevant to this current study. Themes involved in the Reddy et al. (2012) study were perceived barriers and benefits of HPD use in occupational noise. These themes and sub-themes may fit into the constructs of the HBM (Rosenstock, 1974). For example, it may be possible that Theme 3, including; “uncomfortable”, “bulky”, and “communication problems” sub-themes, may be related to the “perceived barriers” construct of the HBM. However, further study is required to confirm these possible relationships.

Tantranont and Codchanak (2017) conducted a recent study, where they investigated factors for and against the use of HPDs in an occupational setting using a similar theoretical framework to the HBM (Rosenstock, 1974). Tantranont and Codchanak (2017) recruited 268 participants from 15 manufacturing plants in Thailand. The Predictors of Use of Hearing Protection Model (PUHPM) that was used as the theoretical framework of the study divided potential predictors of HPD use into two categories: modifying factors and cognitive-perceptual factors. The underlying theory of the PUHPM indicates that modifying factors and

cognitive-perceptual factors individually influence HPD use (Tantranon, & Codchanak, 2017). Modifying factors also influence cognitive-perceptual factors, resulting in an additional indirect effect on the use of HPDs (Tantranon, & Codchanak, 2017). Factors included in the theoretical framework were added by Trantranont and Codchanak (2017) because previous studies have indicated that each factor directly affected HPD use. The two categories of HPD use predictors are as follows:

Modifying Factors:

- Demographic/Experiential factors including;
 - Gender
 - Working duration
 - Perceived ability of hearing
- Interpersonal influence on HPD use (Interpersonal support and modelling)
- Situational factors on the use of HPDs (availability of HPDs, organizational support for HPD use)

Cognitive-perceptual Factors:

- Perceived benefit of HPD use
- Perceived barriers to HPD use
- Perceived self-efficacy in HPD use
- Perceived susceptibility to hearing loss
- Perceived severity of hearing loss

A single-item measured questionnaire was used to collect the demographic information, including; gender, work duration, and self-reported hearing status. Participants of the study were instructed to self-report HPD use while at work using a percentage of time (0% = no HPD use – 100% = use of HPD all the time). Results of the study (Tantranont, &

Codchanak, 2017) revealed that “perceived hearing status” items ($b = 0.81, p < .001$) and “interpersonal influences” items ($b = 0.18, p < .025$) had statistically significant correlations with HPD use. The results revealed that the PUHPM model correctly classified 70.1% of the cases, suggesting that this model may be used as a predictor of HPD use among workers in noise. Consequently, the HBM may also be used to predict HPD use among workers in who work noise, the rationale for this is that, as mentioned previously, the Cognitive-perceptual factors of the PUHPM are similar to the constructs of the HBM. This current study aims to examine the relationship between the constructs of the HBM and HPD use among tradespeople in Christchurch.

The results of the studies conducted by Reddy et al. (2012), and Tantranont and Codchanak (2017) are both indicative of a potential relationship between factors that are similar to the constructs of HBM and HPD use in occupational settings. Further research would be required to examine the relationships between the constructs of these different theoretical frameworks.

Previous researchers investigated the barriers to preventive health actions for occupational NIHL (Patel et al., 2001). Thirty-two individuals from two mines located in the United States of America, who had a substantial risk of obtaining a permanent NIHL, volunteered to participate in the study. It was reported that “fewer than 10% of the participants mentioned that they regularly wore hearing protection” (Patel et al., 2001, p.159), suggesting that these participants were at greater risk to NIHL because of the lack of HPD use. The researchers (Patel et al., 2001) from Michigan State University, the National Institute of Occupational Safety and Health (NIOSH), and the United Mine Workers of America (UMWA) formed focus groups with protocol based from the Extended Parallel Process Model (Witte, 1992) and the HBM theoretical frameworks. The questions in the focus group protocol were separated into four sections which assessed the knowledge and

individual perceptions surrounding the susceptibility and severity of NIHL, determined the levels of self-efficacy, assessed whether barriers discouraged HPD use and what types of barriers were responsible for this, and finally, identifying participants' ideas and suggestions for the development of effective hearing conservation campaigns. The study conducted by Patel et al. (2001) focussed on the third section, which investigated barriers which may inhibit HPD use. Qualitative data was collected from four focus groups using the protocol mentioned previously.

Results from the study revealed barriers which discouraged the use of HPDs among participants, these barriers were separated into two groups; Environmental factors, which were defined as “external realities that act as systemic constraints against behavioural change: they occur outside of the miner’s body or mind” (Patel et al., 2001, p.162), and individual factors, which were defined as “internally perceived cues that prevent engagement of healthy actions: they are perceptions, subjective realities” (Patel et al., 2001, p.163) .

Environmental factors that inhibited participants use of HPDs in an occupational setting included;

- Economy – Economic concerns were reported by participants.
 - Fear of possibly of being demoted or fired from not being able to communicate properly while wearing HPDs.
 - Potential infections that may occur from wearing insert HPDs, such as ear plugs, may have resulted in medical visits that the participants could not afford. This links with the second environmental factor.
- Medical – Medical concerns were reported by participants.

- Participants reported that the use of earplugs has resulted in ear infections for them in the past, and as a result they had stopped using HPDs in an attempt to alleviate that issue.
- Federal regulations
 - Participants reported the lack of federal reinforcement was one reason they did not wear HPDs. In New Zealand noise regulations are managed by WorkSafe New Zealand (WorkSafe, 2018). Thus, one could argue that this factor may not apply to tradespeople in Christchurch, who are the intended population of this current study.
 - It was reported that the participants would not wear HPDs because there is no law regarding the regulation of consistent HPD use. A reported consequence of this was supervisors and foremen were reported to enforce health and safety regulations regarding eyewear, gloves, and proper footwear, however would not enforce the use of HPDs.
- Technology
 - Participants reported they found some HPDs too bulky, uncomfortable, or heavy to wear consistently during their 10 hour working day. This may not be a factor for tradespeople. Tradespeople are generally exposed to environments where background noise fluctuates (Neitzel, Seixas, Goldman, & Daniell, 2004). Thus, tradespeople may not always need to use HPDs.
- Organizational structure of the work groups
 - The participants reported that over several years they have developed systems within their work groups in order to work efficiently, and any change to the systems they had set up could possibly cause a disruption to work efficiency

and work quality. It was reported that participants viewed the use of HPDs as a change that would be detrimental to the work systems already in place.

Individual barriers that inhibited participants use of HPDs in an occupational setting included;

- Perceived hearing ability
 - Participants reported that HPD use made it more challenging to effectively communicate with the members of their work groups.
- Emotional experience
 - Participants reported that they experienced feelings of fear, isolation, and frustration when using HPDs. Participants suggested that HPDs would significantly limit their hearing, causing them to experience feelings of isolation from their colleagues.
- Perceived subjective norms – perceptions of nonhabitual use as the accepted norm.
 - Participants suggested that the lack of HPD use as a social norm may have prevented many workers from using HPDs.

Patel et al. (2001) recruited miners for their study. One could argue that the factors found by Patel et al. (2001) may not apply to tradespeople because of the different occupational settings that miners and tradespeople are in.

The authors of the literature reviewed in this section (Patel et al., 2001; Reddy et al., 2012; Trantranont, & Codchanak, 2017) have made indications to several factors which may influence the use of HPDs. Although these studies were conducted using differing theoretical frameworks, they each indicate factors which may influence the use of HPDs. Factors that influence HPD use may be external, or modifying factors (Patel et al, 2001; Tantranont, & Codchanak, 2017) which happen outside of the individual, and which the individual has no

control over. Internal factors may also influence HPD use, these factors occur within the body and mind of the individual (Patel et al, 2001).

1.4 Health Belief Model

The aim of this study is to investigate the relationship between the constructs of the HBM and HPD use among Christchurch tradespeople in occupational and non-occupational settings. This section of the thesis will include a definition of the HBM as well as an investigation into how the HBM is used in the health industry, including its use in health-related research and hearing related research.

1.4.1 Definition

Rosenstock (1974) constructed the HBM in an attempt to explain or predict the acceptance of health and medical care recommendations. The model proposes that an individual will consider the benefits of a particular intervention and compare whether or not they outweigh the costs and barriers of said intervention. It is this personal valuation of the perceived benefits of an intervention compared with the conflicting barriers and costs that will determine whether or not the individual will act on the intervention or not that is, individuals conduct an internal assessment of the net benefits of changing their behaviour and decide whether or not to act (Green & Murphy, 2014). This individual assessment of an intervention or change of behaviour is broken down into six constructs. These six constructs that form the HBM are (1) Perceived susceptibility, (2) perceived severity, (3) perceived benefits, (4) perceived barriers, (5) perceived self-efficacy, (6) cues to action. The six constructs of the HBM are defined in Table 1.

Table 1: Health Belief Model: Construct Definitions in hearing health related research (Saunders, Frederick, Silverman, & Papesch, 2013).

Construct	Definition of Construct
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Perceived susceptibility	The feeling of being vulnerable to a condition and the extent to which the individual believes he or she is a risk of acquiring the condition.
Perceived severity	The belief in the seriousness of the consequences incurred if affected by the condition both medically and socially.
Perceived benefits	The belief that intervention will result in positive benefits.
Perceived barriers	The barriers an individual believes he or she needs to overcome in order to effectively conduct some form of intervention.
Perceived self-efficacy	The individual's beliefs in his or her ability to use and gain benefit from the intervention.
Cues to action	Cues that prompts an individual to take action, which could be internal, such as symptoms of a health problem, or external such as media communications, interpersonal communications, or information from healthcare providers.

1.4.2 Health related research and use of HBM

In 1966, Kasl and Cobb defined three typical health related behaviours, including;

Health behaviour – “any activity undertaken by a person who believes himself to be healthy, for the purpose of preventing disease or detecting it in an asymptomatic stage”.

Illness behaviour – “any activity, undertaken by a person who feels ill, to define the state of his health and to discover a suitable remedy.”

Sick-role behaviour – “is the activity undertaken by those who consider themselves ill, for the purpose of getting well.”

In 1966, Rosenstock aimed to conduct research that would increase the knowledge of health industry workers concerning research findings and theory so that they may have a better understanding why and when an individual would take action to prevent, detect and diagnose disease. Rosenstock stated in 1966, and again in 1974 that the Public Health Service in the early 1950s was primarily focused on preventing, not treating, disease. During these times it was apparent that patients were not accepting disease preventives or early detection screening tests aimed to identify asymptomatic diseases, such as tuberculosis, gum disease, and influenza. It was from this that the HBM arose. Researchers started developing the HBM around 1952 (Hochbaum et al., 1952). The HBM was first constructed with the goal of improving the public health system, through gaining an understanding of why people have failed to accept these disease preventives, with the primary focus on the factors of health behaviour (Rosenstock, 1966). Rosenstock’s 1966 model came from two classes of variables including; “the psychological state of readiness to take specific action” and “the extent to which a particular course of action is believed on the whole, to be beneficial in reducing the threat.” (Rosenstock, 1966).

1.4.3 Hearing related research and use of HBM

Purdy and Williams (2002) conducted a study with the aim of examining the knowledge and perceptions which individuals have about noise, how it impacts hearing, and

whether these factors can influence their exposure to noise. They did so by using a questionnaire with subscales that are similar to the constructs of the HBM. Purdy and Williams developed a 20-item questionnaire that had good overall reliability and contained five subscales that evaluated the perceived benefits of reducing noise and protecting hearing, perceived barriers to reducing noise, perceived self-efficacy for reducing noise and protecting hearing, attitudes to noise and perceived susceptibility to hearing loss. A total of 44 men and 1 woman with an average age of 43.4 years ($SD = 9.4$ years) from Sydney, Australia participated in this study. Results showed that participants who were uncomfortable in noise wore their HPDs more. Suggesting that an individual's perception of environmental noise effects their likelihood to use HPDs. The results also revealed having a hearing test through work increased the likelihood that the individual would use HPDs. Purdy and Williams (2002) stated that they presumed "this was due to the audiometrist providing some counselling about hearing loss and the effects of noise, rather than the hearing test per se.". Results showed participants who spoke English as a second language perceived the barriers to HPD use as larger. Thus, suggesting that cultural differences between participants may be a factor that influences HPD use. Purdy and Williams (2002) suggested, based off the indications of the results, that "individual worker characteristics should be considered when designing hearing loss prevention programmes". This suggests that there may be a significant amount of individual variance between workers which influence the use of HPDs.

1.4.4 Hearing belief questionnaire

The Hearing Beliefs Questionnaire (HBQ) was developed by researchers (Saunders, Frederick, Silverman, & Papesh, 2013) in an attempt to assess an individual's hearing behaviours that are within the six constructs of the HBM. Originally the HBQ consisted of 60 items. Each item consisted of a statement. Each statement was worded in a way that allowed participants to select a rating on an eleven-point scale. Each point on that scale represented a

certain level of agreement the participant shared with each statement, 0 being “Completely Disagree” to 10 being “Completely Agree”, “5” is used to represent “No Opinion”. Further on in the study, Saunders et al reduced the number of items in the questionnaire from 60 items to 26 items. Saunders et al analysed the results collected from 223 completed questionnaires from a participant pool of 240. The surveys that were not analysed in this study were excluded because they had not been entirely, or correctly completed. The majority of the participants were male war veterans, which differs from the tradesmen that will be analysed in this current study. Saunders et al. (2013) claim there was only one study that had investigated hearing health behaviours within the constructs of the HBM (Van den Brink et al., 1996) before the year 2013. However, as mentioned previously, factors in the results yielded by Reddy et al. (2012) are similar to the constructs of the HBM. The results revealed significant relationships between hearing aid use and the perceived susceptibility, perceived severity, perceived benefits, perceived barriers, and cues to action constructs. The items in the HBQ which represented the perceived self-efficacy construct did not have a significant relationship with hearing aid use.

1.4.5 Conclusions

Saunders et al. (2013) stated that the HBM may be applicable to hearing health behaviours and that the HBQ may be utilised in the assessment of hearing health beliefs and for predicting hearing aid use among veterans in the United States. This current research examined how an adapted version of the HBQ (Saunders et al., 2013) may be used in identifying and predicting HPD use among tradespeople in Christchurch. The hypotheses of this current study include;

- The adapted HBQ may be used to assess the constructs of the HBM, and predict HPD use among tradespeople in Christchurch.

- The relationship between the constructs of the HBM and HPD use among tradespeople in Christchurch will be statistically significant.

An adapted HBQ with additional items which address, age, gender, hours exposed to noise at work/not at work, hours wearing HPDs at work/not at work, self-reported hearing loss, self-reported hearing assessment in the last 2 years, will be used to examine whether the findings from the study conducted by Saunders et al. (2013) can be replicated with tradespeople in the city of Christchurch and whether it results in a questionnaire in which a self-efficacy scale emerges. The purpose of this research is to examine the relationship between the constructs of the HBM and HPD use among Christchurch tradespeople.

Chapter 2: Methods

2.1 Overview

This current study has received approval from the University of Canterbury's Human Ethics committee (Appendix 1).

2.1.1 Original survey

The HBQ designed by Saunders et al. (2013) was designed to assess hearing beliefs within the constructs of the HBM and investigate whether the HBQ scores are associated with hearing health behaviours (Saunders et al., 2013).

2.1.2 Adapted survey

The survey used in this research investigation includes two parts (Appendix 2). The first part of the survey asks 10 demographical questions surrounding the occupation of the participant, the hours of occupational/non-occupational noise exposure, and the hours of occupational/non-occupational HPD use.

The first part of the survey asked questions directed at obtaining demographical information surrounding the use of HPDs among Christchurch tradespeople in occupational and non-occupational settings. The primary questions in the first part of the survey had to identify how long participants were exposed to occupational and non-occupational noise in average hours per day, and how long the participants use HPDs when they are exposed to noise in average hours per day. Other demographical information attained by the questions asked in the first part of the survey includes age, gender, and occupation of the participant. Age and gender information was collected in case any of these variables revealed any significant trend in relation to hearing protection use or HBM construct score. The occupation

of the participants was an important variable that needed to be controlled for in the current study as several trades are more likely to be exposed to excessive noise than others.

The second part included 26 statements surrounding hearing health and the use of HPDs in noise. Part 2 of the survey uses Likert scales for each statement. The scales ranged from 0 (completely disagree) to 10 (completely agree) and the participants were instructed to choose a point along the scale that they felt best represented their opinion of each statement. The questionnaire used in this research investigation was primarily modelled from the HBQ (Saunders et al., 2013).

2.1.3 Development/selection of survey questions

The first part of the online survey was developed to obtain demographic information. The questions asked in the first part of the survey were designed to identify participant age, occupation, exposure to noise per day in occupational and occupation settings, and how often hearing protectors are being worn during that exposure to noise.

The statements used in the second part of the survey in this current investigation were adapted from the 26 statements used in the HBQ (Saunders et al., 2013). The original statements were based on the constructs of the HBM and were created to investigate the relationship between these constructs and hearing aid use amongst veterans, consequently the statements of the HBQ were adapted in order investigate the relationship between the constructs of the HBM and hearing protection use among Christchurch tradespeople in occupational and non-occupational settings.

2.1.4 Method flow

The HPD adapted version of the HBQ used in this current study was developed over 3 stages.

The three stages of this study flowed in order as show in Figure 1;

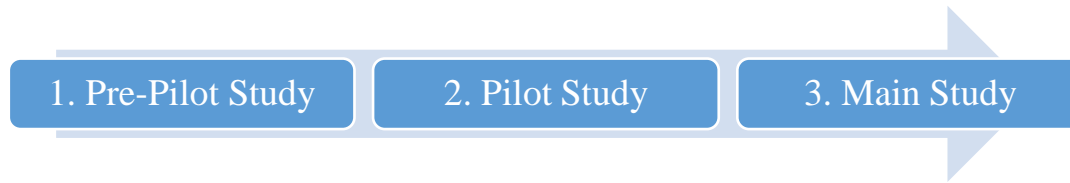


Figure 1: Order of the three stages in the study.

The following sections of this chapter discuss the three stages of this current study, the purpose of each stage, the participants involved in each stage and how they were recruited. The resulting changes made because of the results of the first two stages, and descriptions of the statistical analysis of the data gathered in the final stage of the study are also discussed in the following sections.

2.2 Stage 1: Pre-pilot study

2.2.1 Purpose

The pre-pilot study was carried out in order for a third party to test the online survey. The purpose of the pre-pilot was to allow the researcher to check for any errors that may be included in the initial version of the online survey. Potential errors that may have been included in the initial version of the survey include; typographical errors, flow of the questions, and question content.

2.2.2 Participants & Recruitment

Participants involved in the pre-pilot study included colleagues, friends, and family. The researcher approached each individual and verbally invited them to participate in the pre-pilot study. Participants of the pre-pilot study were instructed to complete the online survey and then report back to the researcher with any comments regarding. A total of 14 participants were recruited for the pre-pilot study.

2.2.3 Resulting Changes

Originally a pre-pilot study was conducted which involved 14 participants. The occupation of the participants involved in the pre-pilot study was not controlled for as occupation had no effect on the outcome of the pre-pilot study. The pre-pilot study was carried out in order for a third party to test the online survey. Participants involved in the pre-pilot were instructed to complete the survey while checking for typographical errors, flow of the questions, and question content. Upon completion of the pre-pilot study revealed typographical errors that were then corrected. Some of the question content also needed adjustment.

2.3 Stage 2: Pilot study

2.3.1 Purpose

The pilot study's purpose was to be a practice run for the main study. The pilot study allowed the researcher to test the survey after making the resulting changes from the pre-pilot study. Although data collected in the pilot study could not be used for the main study it gave the researcher an opportunity to look at data from tradespeople in Christchurch. No assumptions about the main study were made using the data collected in the pilot study. The pilot study was also used to identify further possible errors in the online survey.

2.3.2 Participants & Recruitment

The occupation of the participants involved in the pilot study was controlled for. Participants involved in the pilot study were tradespeople. All of the participants in the pilot study were friends of the researcher and were individually invited to participate by the researcher. The researcher instructed the participants to complete the online survey and report back with any feedback or suggestions they felt they should make. Initially the study intended

to recruit 10 participants for the pilot study. Upon completion of data collection, a total of 9 participants were recruited for the pilot study.

2.3.3 Resulting Changes

The data gathered from the pilot study was not statistically analysed. However, pilot testing revealed that some trades occupations are often exposed to less noise than initial assumptions made by the researcher. Participants with occupations including electricians and quantity surveyors in the Christchurch area are only exposed to an average of an hour per day. As stated by the New Zealand Occupational Health and Safety service (2002, p.10) temporary shifts in hearing thresholds are likely to occur when an individual's "exposure to noise exceeds the equivalent of 85 dB(A) for 8 hours, or a peak sound pressure level of 140 dB" and repetitive exposure to such excessive noise can result in a permanent threshold shift. The average length of time that the occupations mentioned are exposed to noise would not likely cause any temporary or permanent shifts in hearing thresholds. Consequently, HPDs are less likely to be worn by these tradespeople. Therefore, the researcher decided that tradespeople who are exposed to noise for less than an average of 3 hours per day were added to the participant recruitment exclusion criteria. Participants of the pilot study were instructed to offer feedback regarding typographical errors and online survey flow. However, all of the participants reported that they did not have any suggestions regarding this. Pilot testing revealed that some participants were not answering all of the questions which resulted in incomplete sets of data, thus it was decided by the researcher that participants should be "forced" to answer each question in the survey in order to obtain more complete information.

2.4 Stage 3: Main study

2.4.1 Purpose

The purpose of the main study was to collect data in order to investigate the relationship between the constructs of the HBM and HPD use among Christchurch construction workers in occupational and non-occupational settings.

2.4.2 Participants & Recruitment

Participants for the focus of the subsequent, main research investigation, had to include tradespeople who are exposed to noise for extended periods of time each day. This included anyone who works around, or uses, loud machinery or noise-generating tools as part of their primary job. Originally, the method was to include anyone affiliated with a building site that may incidentally be exposed to loud noise such as: quantity surveyors, project managers, and architects. However, as explained further on in this current study, these certain occupations are not exposed to noise for a period of time that would likely cause any damage to their hearing. Loud noise is defined as 85 dB A, which is the level that requires hearing protection over an eight-hour work day according to the New Zealand standard for noise exposure in an occupational setting (Occupational Safety and Health Service, 2002).

Tradespeople have been chosen to participate because they are often at risk of exposure (direct or incidental) to industry-related noise and may require the use of a HPD as part of their job. Individuals who agreed to participate in this study were given either the laptop or iPad in order to complete the online survey. The completion of the online survey flowed in this manner:

1. The researcher began by giving the potential participants written or verbal information regarding the study. This information also reaffirmed their right to exit the survey and the study at any time, without having provided a reason or rationale.

2. Potential participants received information about the participant inducements associated with the study: 3x \$100 Westfield vouchers. They were informed that if they wished to go in the draw to potentially win one of these inducements, they would have to provide an email contact (should they win the draw) after the survey concluded.

3. Potential participants who gave their verbal consent to participate in the study then were provided an electronic study consent form via the iPad or laptop. Participants were then required to indicate they consented to participating in the study, before the website allowed them to proceed to the next part of the online survey.

4. Participants were given opportunity to request a copy of a summary of the study's overall findings.

5. After consenting, the participants were then taken to the next part of the online survey where the participant could then nominate an email: 1) should they win the drawing for one of the participant inducements, or 2) if they wished to receive a summary of the study's overall findings, or 3) if they wish to receive a copy of the study information sheet and consent form. Participants were not required to provide an email if they did not wish to go in the draw for the inducements or did not wish to receive a summary of the study's overall findings, or a copy of the information sheet and consent form.

6. Once steps 1-5 were completed, the website then enabled/opened the first part of the survey to the participant. The survey was the only task the participants were required to perform. Each survey took approximately 5 minutes to complete.

7. Once steps 1-6 were completed, the online survey thanked them for their participation and automatically closed. The researcher or research assistant then offered the participant a can of soda and a chocolate bar to thank them for participating in this study.

All information associated with the survey was gained in such a way that the employees endorsing the survey will not be readily identifiable. Participation and survey information provided was kept strictly confidential and anonymous. All completed online surveys featured a unique alpha-numeric code, to eliminate any potential identifying information. A summary of results was sent to participants who made a request for them. Participants who wanted to enter the draw to win one of the three vouchers were assigned a number. A random number generator was used to select the three winning participants in the voucher draw. The three winning participants have now each received one \$100 Westfield voucher.

Due to a lack of previous research for Christchurch a relatively conservative effect size of $r^2 = .3$ was used to constitute a clinically significant effect size. Statistical power was specified at the recommended 0.8 and the level of significance at 0.008 (using a Bonferroni correction for each statistical test to keep the experiment-wise alpha-level at $p < .05$).

2.4.3 Data Collection Locations

The researcher went to building supply stores around Christchurch city to collect the data in this current research investigation. Building supply stores were chosen for data collection because they supply tools and materials required by most tradespeople and are visited frequently by those tradespeople. The researcher was informed by the manager of a building supply store that most tradespeople visit the stores between the hours of 7am and 10am in order to obtain materials for the day's job. These building supply stores proved to be successful locations for obtaining data during these hours of 7am and 10am as all of the participants involved in this current research investigation were recruited at these stores and at these times.

2.4.4 Instrumentation

The survey was presented to participants in electronic format through the online survey software Qualtrics. Participation also required those involved to complete the online survey from a computer, tablet, or smartphone. The Communication Disorders department at the University of Canterbury supplied the researcher with a Laptop and an iPad. All of the data that was collected at building supply stores was collected via an online survey on either the iPad or Laptop. Participant inducement involves a prize draw to win one of three \$100 shopping vouchers. To become eligible, participants were required to tick a box agreeing to “go into the draw” and provide had to provide a contact email. Other inducements included cans of coke and chocolate bars.

2.5 Statistical Treatment

2.5.1 Variables

The dependent variables for this current study were the 6 HBQ construct scores. There were two independent variables under investigation: 1) HPD use in occupational settings and 2) HPD use in non-occupational settings.

2.5.2 Data Handling

Surveys were completed using Qualtrics software on a laptop and iPad provided by the University of Canterbury. Statistical analysis of the data collected was completed using IBM SPSS version 25 statistical software

2.5.3 Planned Analyses

Means, standard deviations, range, and frequency counts were used to describe the variables of this research investigation. One-tailed Pearson correlations were used to address the study hypotheses. It was expected that the results of this study would provide information

about how the HBM may be related to HPD use in both occupational and non-occupational settings. This information may serve to inform further research on HPD use in the New Zealand context.

Chapter 3: Results

3.1 Descriptive

The aim of the first section of the current study was to identify hearing protection use among tradespeople in Christchurch in occupational and non-occupational settings. The first section of this chapter describes the age, occupation, hearing health, hours exposed to noise in an occupational setting, access to HPD in occupational and non-occupational settings, and use of HPD in occupational and non-occupational settings of the participants involved in this current study.

3.1.1 Participants

The total number of participants involved in the final study equalled 64. The participants who reported to have spent less than 3 hours in noise at work were excluded from the results of the final study. The total amount of participants remaining in the study, after that exclusion was made, equalled 44. A total of 43 identified as male, 1 participant identified as female. The results obtained from these 44 participants are described in this chapter.

3.1.2 Age

The participants by distribution of age are shown in figure 2. The mean age of the participants in this study was 40.45 years of age, with a standard deviation of 13.82. The youngest participant in this study was 21 years of age. The oldest participant in this study was 70 years of age. The skewness ($Z = 1.19$) and kurtosis ($Z = -1.02$) results of the age of the participants had no statistically significant bias.

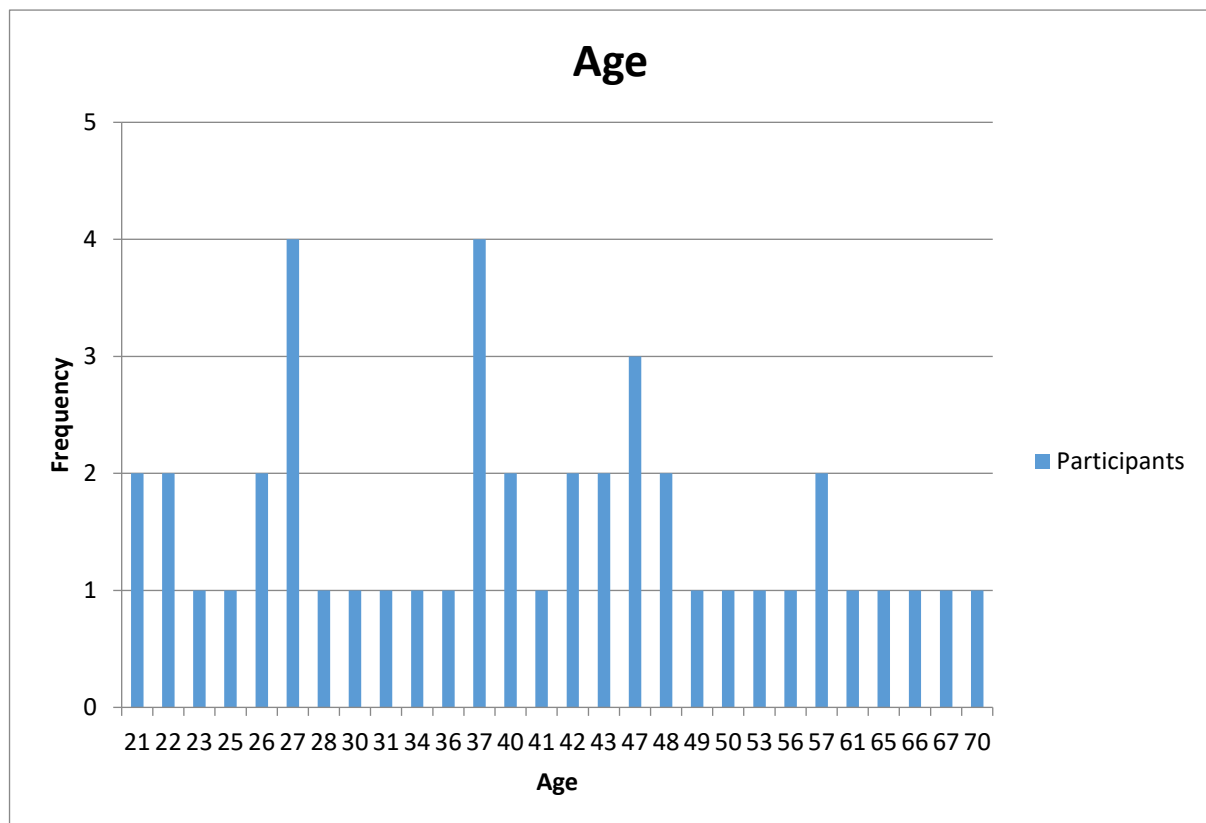


Figure 2: Participants by distribution of age.

3.1.3 Occupation

Participants of this study were asked to identify their current occupation. The participants by distribution of occupation are shown in figure 3. A total of 21 participants identified as a Builder/Carpenter. This occupation accounted for 47.7% of the total population.

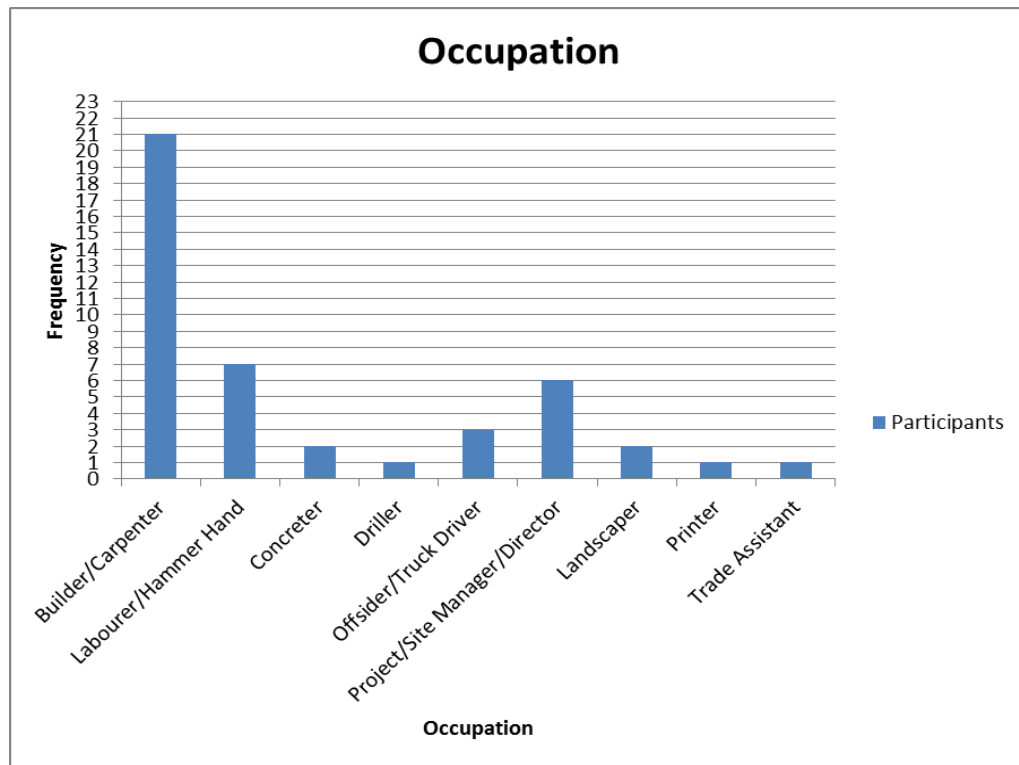


Figure 3: Participants by distribution of occupation.

3.1.4 Hearing test

Participants of this study were asked to identify whether they had received a hearing test in the last 2 years. A total of 31 participants stated they had not received a hearing test in the last two years. This result accounted for 70.6% of the total population.

3.1.5 Hearing loss

Participants of this study were asked to identify whether or not they had a hearing loss. The participants by distribution of hearing loss are shown in figure 4. Out of the total 44 participants, 21 of them reported to have a hearing loss. These results indicate that 44.7% of the population in this study had a hearing loss. A 1-tailed Pearson correlation was performed to examine the relationship between hearing loss and exposure to noise. No statistically significant relationship was found between these two variables ($r = -.152$, $p = .162$).

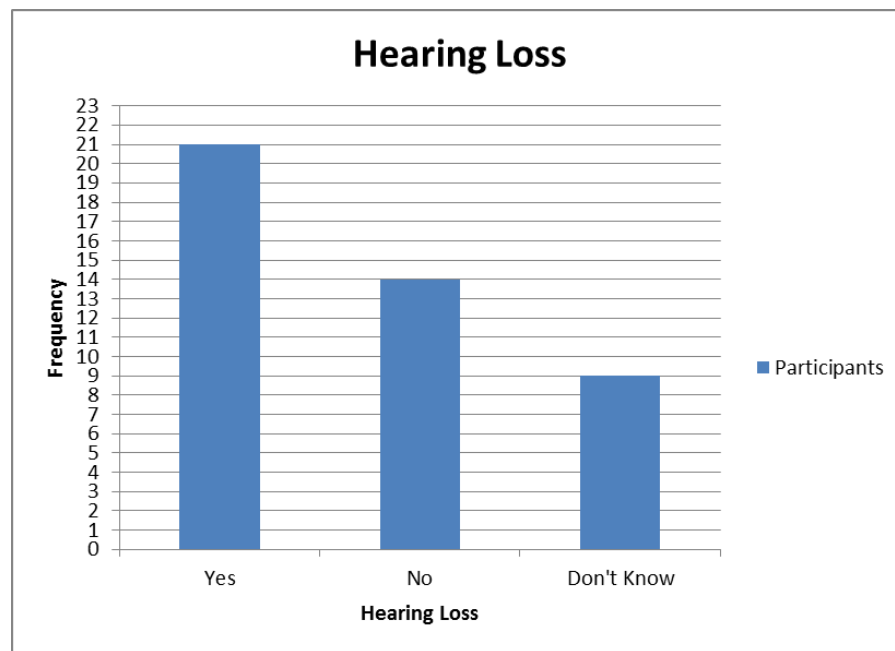


Figure 4: Participants by distribution of hearing loss.

3.1.6 Noise at work

Participants of this study were asked to self-report the amount of time they spend in noise while at work. The participants by distribution of hours they spend in noise at work per day is shown in figure 5. The results suggest that participants spend a mean of 5.27 hours exposed to noise in an occupational setting ($SD = 1.68$). The skewness ($Z = 1.62$) and kurtosis ($Z = -1.47$) results of the hours exposed to noise at work had no statistically significant bias. The participants by distribution of average hours wearing HPD at work per day is shown in figure 5.

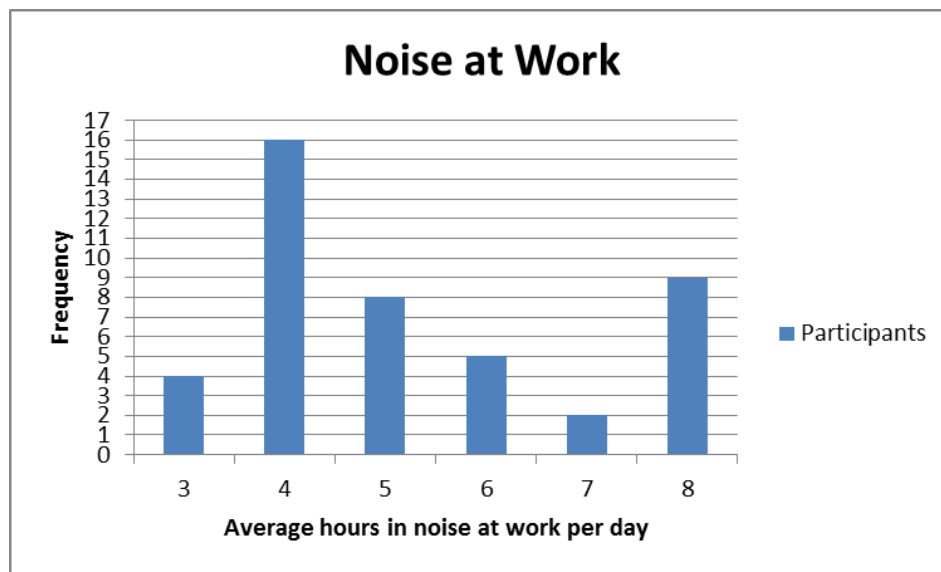


Figure 5: Participants by distribution of average hours spent in noise at work per day.

3.1.7 Hearing protection in an occupational setting

Participants were asked if they had access to HPDs at work. The results show that all of the participants had access to HPD in an occupational setting. Participants were then asked to self-report how long they wear HPD at work (average hours per day). Results suggest that participants spend a mean of 4.27 hours wearing HPDs in an occupational setting ($SD = 2.26$). The skewness ($Z = 0.18$) and kurtosis ($Z = -1.22$) results of the hours wearing HPDs at work had no statistically significant bias. The participants by distribution of average hours wearing HPD at work per day is shown in figure 6.

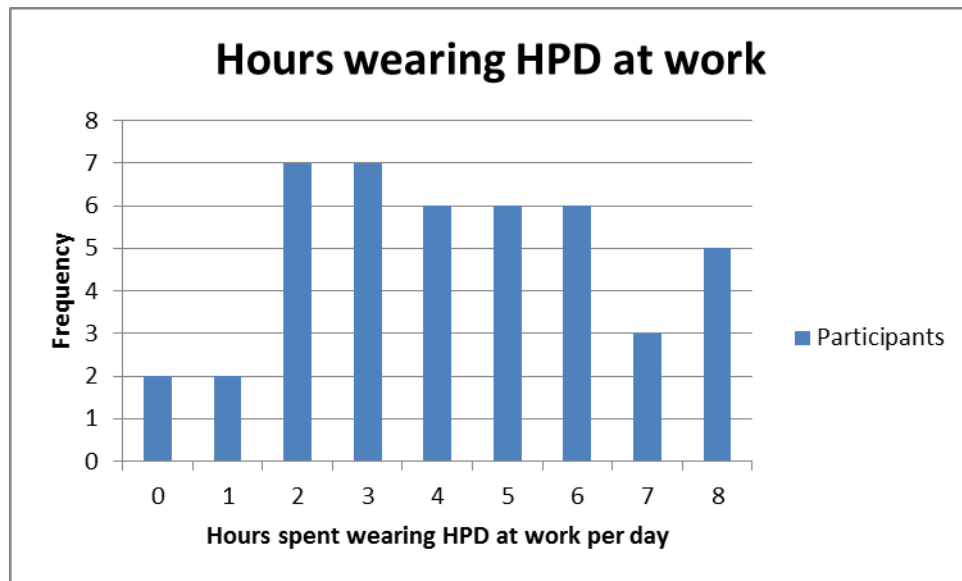


Figure 6: Participants by distribution of HPD use in an occupational setting.

3.1.8 Hearing protection in a non-occupational setting

Participants were asked if they have access to HPDs outside of work. A total of 42 participants reported they had access to HPDs outside of work. A total of 2 participants reported that they did not have access to HPD outside of work. Participants were asked how many hours they wear hearing protection outside of work (hours per week). The results suggest the mean time that participants were wearing hearing protection in a non-occupational setting was 1.14 hours per day (SD = 1.03). Kurtosis ($Z = 1.72$) calculations revealed normal kurtosis for this variable. However, Skewness ($Z = 3.00$) calculations revealed a positive skew. This positive skew indicates that the data was not normal with respect to the number of hours that tradespeople wear HPDs in a non-occupation setting. Participants by distribution of average hours spent wearing HPD outside of work per week is shown in figure 7.

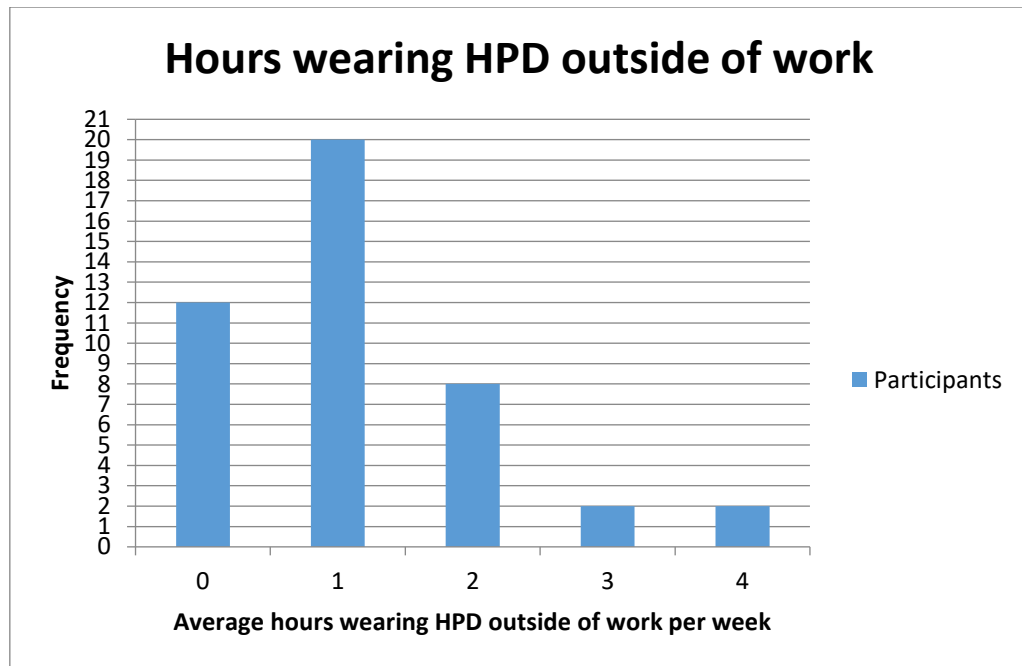


Figure 7: Participants by distribution of HPD use in a non-occupational setting.

3.2 Questionnaire

The second part of the study investigated the relationship between the constructs of the HBM and HPD use among tradespeople in Christchurch. The second section of this chapter investigates the relationships between the adapted HBQ scores and hours of HPD use.

3.2.1 Correlation between HPD use in an occupational setting and average hours exposed to noise at work.

A 1-tailed Pearson correlation was performed to investigate the relationship between the average hours a participant is exposed to noise at work per day and the use of HPDs in an occupational setting. Results reveal no significant relationship between these two variables ($r = .236, p = .061$). This indicates that HPD use may not be influenced by the average amount of time that participants spend in noise.

3.2.2 Correlations between HBQ questions and HPD use in occupational and non-occupational settings

A 1-tailed Pearson correlation was performed to investigate the relationship between the individual questions in the adapted HBQ and the average hours participants reported wearing HPDs in occupational and non-occupational settings.

Correlations between questions in adapted HBQ and participant hours wearing HPDs in occupational and non-occupational settings

HBQ Questions	Occupational	Non-occupational
1. My hearing will likely get worse in the future.	$r = -.06, p = .34$	$r = .34, p = .01$
2. It is possible that I will lose my hearing.	$r = -.15, p = .16$	$r = .20, p = .09$
3. *I am not likely to lose my hearing because hearing loss doesn't run in my family.	$r = .02, p = .43$	$r = .16, p = .14$
4. I've heard you should get your hearing tested now and then.	$r = .03, p = .41$	$r = .18, p = .12$
5. Having a hearing loss would limit my daily activities	$r = -.16, p = .15$	$r = -.10, p = .27$
6. When people have hearing loss, their relationships with family and friends suffer.	$r = .03, p = .43$	$r = .08, p = .31$
7. Having a hearing loss negatively impacts a person's job performance.	$r = -.36, p = .01$	$r = -.06, p = .34$
8. The benefits of using hearing protection devices would outweigh the costs.	$r = .08, p = .30$	$r = .070, p = .33$
9. I would worry if I had a hearing loss.	$r = -.04, p = .40$	$r = -.13, p = .20$
10. *I don't go out much so having a hearing loss wouldn't be a big problem for me.	$r = .31, p = .019$	$r = .133, p = .19$
11. If I had a hearing loss, I would worry about missing important information during visits with my doctor.	$r = -.01, p = .46$	$r = -.04, p = .40$

12. It would be stressful to have a hearing loss.	$r = -.05, p = .38$	$r = -.15, p = .16$
13. I am too young to have a hearing loss.	$r = .06, p = .35$	$r = -.09, p = .27$
14. It is uncomfortable wearing hearing protection devices (ear-muffs and ear-plugs included).	$r = -.01, p = .46$	$r = -.12, p = .21$
15. Hearing protection devices aren't worth the trouble.	$r = -.070, p = .33$	$r = -.29, p = .03$
16. Hearing protection devices are ugly.	$r = .14, p = .18$	$r = -.09, p = .28$
17. Most people say hearing protection devices don't work well.	$r = -.20, p = .10$	$r = -.24, p = .06$
18. I usually notice when someone is wearing hearing protection.	$r = -.14, p = .18$	$r = -.17, p = .14$
19. I have heard good things about hearing protection devices.	$r = .16, p = .14$	$r = .23, p = .06$
20. I know where to get hearing protection devices at work if I needed them.	$r = .04, p = .40$	$r = .28, p = .03$
21. I know where to get hearing protection devices outside of work if I needed them.	$r = .08, p = .31$	$r = .26, p = .04$
22. My work place encourages the use of hearing protection devices.	$r = .11, p = .24$	$r = .17, p = .13$
23. *Once you have a hearing loss there's not much you can do about it.	$r = -.21, p = .09$	$r = .21, p = .09$
24. *It would be difficult to use hearing protection devices at work.	$r = .21, p = .09$	$r = -.23, p = .06$
25. *It would be difficult to use hearing protection devices outside of work.	$r = .12, p = .22$	$r = -.32, p = .02$
26. Hearing protection devices are easy to lose.	$r = -.04, p = .39$	$r = -.06, p = .35$

Table 2: 1-tailed Pearson correlation between individual questions of the HBQ and HPD use in occupational and non-occupational settings. r = Pearson Correlation, p = Statistical significance (1-tailed), $N = 44$, * = Item was reverse-scored.

Question 10 and HPD use in an occupational setting had a statistically significant correlation at a 0.05 level. Question 7 had a statistically significant relationship with HPD use in an occupational setting at a 0.01 level. Questions 1, 15, 20, 25 all had statistically significant relationships with HPD use in a non-occupational setting at a 0.05 level. These results indicate that questions 10 and 7 may be predictors of HPD use in an occupational setting, and questions 1, 15, 20, and 25 may be predictors of HPD use in a non-occupational setting.

3.2.3 Factor analysis

A factor analysis and reliability analysis were run to determine whether the adaption of the HBQ used in this current study caused any changes to the original factor analysis run by Saunders et al. (2012). The results of those analyses are as follows in table 3.

Factor	Item	Loading	Variance Explained	Reliability
1	1: My hearing will likely get worse in the future.	.672	23.37%	.621
	4: I've heard you should get your hearing tested now and then.	.728		
	14: It is uncomfortable wearing hearing protection devices (ear-muffs and ear-plugs included).	-.654		
		-.642		
		-.876		

	24: *It would be difficult to use hearing protection devices at work. 25: *It would be difficult to use hearing protection devices outside of work.			
2	2: It is possible that I will lose my hearing. 18: I usually notice when someone is wearing hearing protection. 19: I have heard good things about hearing protection devices. 20: I know where to get hearing protection devices at work if I needed them. 21: I know where to get hearing protection devices outside of work if I needed them. 22: My work place encourages the use of hearing protection devices.	.820 .739 .517 .704 .605 .822	11.29%	.650
3	9: I would worry if I had a hearing loss. 10: *I don't go out much so having a hearing loss wouldn't be a big problem for me. 12: It would be stressful to have a hearing loss. 26: Hearing protection devices are easy to lose.	.631 -.847 .673 .572	9.34%	.261
4	11: If I had a hearing loss, I would worry about missing important information during visits with my doctor.	-.544 .820 .604 .810	7.65%	.175

	15: Hearing protection devices aren't worth the trouble. 16: Hearing protection devices are ugly. 17: Most people say hearing protection devices don't work well.			
5	13: I am too young to have a hearing loss. 23: *Once you have a hearing loss there's not much you can do about it.	740 .604	6.21%	.590
6	3: * I am not likely to lose my hearing because hearing loss doesn't run in my family 5: Having a hearing loss would limit my daily activities	-.769 .847	5.67%	.502
7	6: When people have hearing loss, their relationships with family and friends suffer. 7: Having a hearing loss negatively impacts a person's job performance.	.761 .531	4.97%	.595

Table 3: Factor and reliability analysis results of the adapted HBQ. * = Item was reverse-scored.

3.2.4 Regression analysis.

A linear step-wise regression ($p < .05$ to enter, $p > .10$ to be removed) was performed to predict hours of HPD use based on the HBQ using the new factor structure. The normal P-P (probability-probability) plot for hours wearing an HPD at work and expected cumulative probability is shown in Figure 9. The P-P plot indicates that the assumption of normal distribution was met. No significant variables were entered into the regression equation. A

linear step-wise regression ($p < .05$ to enter, $p > .10$ to be removed) was then performed to predict hours of HPD use based on the HBQ using the original factor structure (Saunders et al., 2013). Again, no significant variables were entered into the regression equation. These results indicate that the HBQ was not able to predict HPD use in this sample.

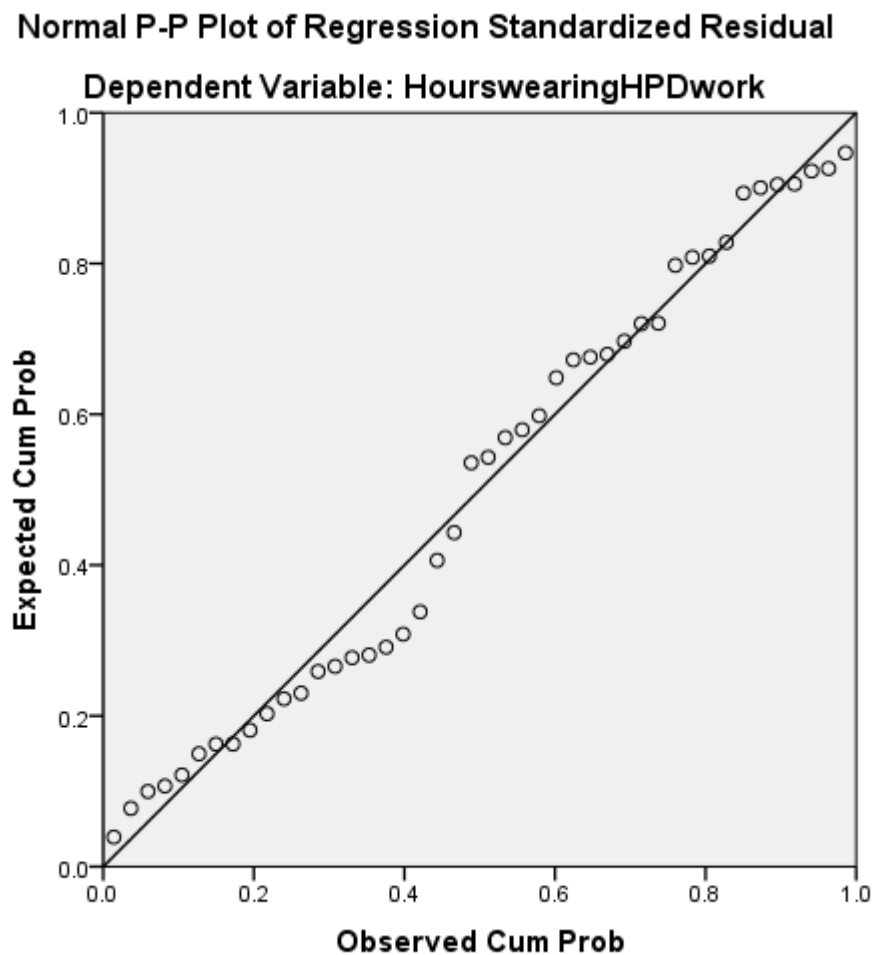


Figure 8: Normal P-P (probability-probability) plot for hours wearing an HPD at work.

3.3 Conclusion of results.

In conclusion to this chapter, the results reveal that no significant variables were entered into the regression equations when linear step-wise regressions ($p < .05$ to enter, $p > .10$ to be removed) were performed to predict hours of HPD use based on the HBQ using the original factor structure (Saunders et al., 2013) or to predict hours of HPD use based on the adapted HBQ using the new factor structure. Consequently, the adapted HBQ cannot examine the relationship between the constructs of the HBM and HPD use among tradespeople in Christchurch in occupational settings.

Question 10 and question 7 of the HBQ have significant correlations with HPD use among tradespeople in Christchurch. Thus, these questions may be predictors of HPD use among tradespeople in Christchurch. Questions 1, 15, 20, and 25 all had statistically significant relationships with HPD use in non-occupational settings, thus they may be used to predict HPD use among tradespeople in Christchurch in a non-occupational setting.

Chapter 4: Discussions

4.1 Results

This chapter will discuss the findings of the current study including the demographical information, and the adapted HBQ as a tool to assess the relationship between the constructs of the HBM and HPD use among Christchurch tradespeople in occupational and non-occupational settings.

4.1.1 Correlations

It is firstly important to note the HBM may not be an appropriate theoretical model for assessing the use of HPDs among Christchurch tradespeople. Occam's razor is considered as one of the "fundamental tenets of modern science" (Domingos, 1999). The Occam's razor philosophy is interpreted as the simplest reason being the preferable or likely reason for an outcome. The simplest implication of the results of this current study was there is just no statistically significant relationship to be found between the constructs of the HBM and predict HPD use in occupational and non-occupational settings. However, previous literature would support the underlying theory that the HBM can be used as a theoretical model to assess HPD use (Purdy, & Williams, 2002; Tantranont, & Codchanak, 2017), thus one could argue that there may be a significant relation relationship between these variables.

Few items in the adapted HBQ had a statistically significant relationship with HPD use in occupational and non-occupational settings. As mentioned earlier, this may be because the items in the adapted HBQ cannot investigate the health behaviour, that is the use of HPDs while exposed to noise, among Christchurch tradespeople. However, other possible explanations for the results found in this current study are as follows.

A change in population, from veterans in the United States to tradespeople in Christchurch, may have affected the correlation between the factor constructs and the

independent health beliefs of the participants. Cultural differences (Purdy, & Williams, 2002) between New Zealand and the United States, and occupational differences between tradespeople and veterans may have affected how the participants of the current study perceived the items in the adapted HBQ compared to how the participants perceived the items in the original HBQ in the study conducted by Saunders et al (2013).

The results revealed there was no statistical significance between average hours exposed to noise in an occupational setting and average hours wearing HPDs in an occupational setting. These results indicate that the amount of time exposed to noise in an occupational setting may not be a factor that influences the use of HPDs in that setting among tradespeople in Christchurch. The intermittent time that tradespeople are exposed to noise could explain why there is no relationship between exposure and HPD use. Several types of equipment including; small powered tools (e.g. circular saw), manual tools (e.g. hammer), and larger powered tools (e.g. drop saw, jackhammer) are operated by tradespeople during various stages of a construction project (Barkokébas et al., 2012) Therefore, tradespeople may never develop a habit of wearing HPDs because of the intermittent nature of the occupational noise they are exposed to and the variability of tasks that they perform at different stages of a project.

Results of this study revealed no statistically significant relationship between the amount of time participants reported to be exposed to noise at work and self-reported hearing loss. Previous evidence that duration of noise exposure is a significant predictor of objective NIHL (Leensen et al., 2011; Pelegrin et al., 2015). Consequently, the duration of noise exposure is not an indicator of a self-reported hearing loss. Objective hearing thresholds of the participants were not measured in this current study.

Participants of this current study reported spending a mean of 5.27 (SD = 1.68) hours exposed to noise in an occupational setting. Two out of the forty-four participants reported not wearing HPDs when exposed to noise. However, participants reported wearing HPDs for a mean 4.27 (SD = 2.26) hours when exposed to noise in an occupational setting. This indicates that the population of the current study are wearing HPDs for a majority of the time they were exposed to noise in an occupational setting. Consequently, there was little variance in the dependent variable, suggesting that a majority of tradespeople in Christchurch are already ready using HPDs for a majority of the time they are exposed to excessive amounts of noise at work. Variance of usage of HPDs while exposed to noise may have affected the findings. Expanding the sample size in future studies may account for more variance, if there is any. No indication can be taken from the results when investigating why participants are not wearing HPDs for the full duration of noise exposure.

Researchers have previously suggested that there are several differing factors which may influence the use of HPDs in an occupational setting. As mentioned previously, some of the potentially influencing factors are similar to the constructs of the HBM (Tantranont, & Codchanak, 2017). However, there are potential factors that influence HPD use that are different from the constructs of the HBM such as work place influence, and the requirement to wear HPDs while at work (Reddy et al, 2012). These factors may be described as “external” or “modifying” factors that happen outside the body and mind of the individual which they have no control over (Patel et al., 2000 Tantranont, & Codchanak, 2017). There may be external factors that are possibly influencing the internal perceptions that Christchurch tradespeople have towards HPD use (Tantranont, & Codchanak, 2017). External factors such as, work requirement factors, interpersonal influence on HPD use (interpersonal support and modelling), situational factors on the use of HPDs (availability of HPDs, organizational support for HPD use), medical factors, economic factors, and work group

factors (Patel et al., 2001; Reddy et al., 2012; Trantranont, & Codchanak, 2017) were not assessed in this current study. Consequently, it may be these external factors that are affecting the relationship between the constructs of the HBM and HPD use among Christchurch tradespeople. The adapted HBQ did not assess the potentially influencing factors that do not relate to the constructs of the HBM, therefore the adapted HBQ may not be able to identify the independent variables that predict HPD use among tradespeople in an occupational setting in Christchurch.

4.1.2 Regression analysis

Linear regression was performed on the old, and new factor structures. Results revealed there was no statistically significant correlation between the new factors and HPD use in an occupational setting. Indicating that the items in the scores of the old, and new factor structures may not predict HPD use in occupational and non-occupational settings among tradespeople in Christchurch. The items in the second section of this current survey were adapted from items in a survey by Saunders et al. (2013). The original questionnaire (Saunders et al, 2013) was developed to assess hearing beliefs within the constructs of the HBM, and to examine the relationship between HBQ scores and health belief behaviour. The original survey (Saunders et al, 2013) was comprised of questions aimed at assessing the hearing health beliefs of hearing aid use among veterans in the United States. The adapted HBQ assessed in this current study was comprised from items in the original HBQ (Saunders et al, 2013) and adapted them to investigate hearing health beliefs of HPD use among tradespeople in Christchurch. It may be possible that the change of dependent variable, from hearing aids to HPDs, may have affected the correlation between the constructs and the independent health beliefs of the participants.

The 7 new factor groups revealed in this study do not relate to the constructs of the HBM. This may be because the items that make up each individual factor may not group appropriately within the context of the constructs of the HBM. For example, Factor one includes; Q1, Q4, Q14, Q24, and Q25. For the old factor analysis Q1 and Q4 were grouped in the Perceived Susceptibility factor group, Q14 was grouped in the Perceived Barriers factor group, and Q24 and Q25 were grouped in the Perceived Self-Efficacy factor group. This indicates the new factor groups may be poor representations of the constructs of the HBM not because of the factor groups themselves, but because of the items that make up each factor group.

4.2 Limitations

A total of 66 participants were interviewed at two construction supply stores in the city of Christchurch. These locations were chosen because of their location and purpose. Tradespeople would come into these stores in the mornings to collect supplies they needed for the days job. One store was in Hornby, the other store was located near the centre of the city. The combined location of these stores the western, southern, and central geographical areas of Christchurch. However, there remains a large amount of the city, including the northern and eastern areas where tradespeople work and live, that was not covered in this study. Thus, there is no representative sample of Christchurch.

A total of 44 participants were included in statistical analysis, the remaining participants were excluded because they reported spending less than 3 hours in noise per day, indicating that while they were still at risk of a NIHL, their risk would be significantly smaller than those who worked exposed to noise. The limitation to having a smaller sample means the results of this study yielded results that would have a smaller effect size than originally proposed.

The demographical information was collected in the first part of the online survey including, hours exposed to noise in work per day, and hours wearing hearing protection at work. One limitation of this current research was that the information about exposure to noise in an occupational setting, and HPD use while in noise was self-reported by the participant. As mentioned earlier, results from previous research indicates that individuals who work in steady background noise are more likely to self-report the use of HPDs with greater accuracy than individuals who work in fluctuating background noise (Griffin et al, 2009). Many of the tradespeople are exposed to noise that fluctuates rather than remains constant. This is because of certain tasks tradespeople are required to perform, such as the use of manual and power tools, these tasks are often intermittent. Therefore, it is possible that the self-reported information is an inaccurate representation of how long the participants are exposed in noise, or the amount the amount they use HPDs while exposed to the noise.

4.3 Recommendations for future research

Future studies should aim to cover a larger area of the city, including these northern and eastern sections that were unexamined in this current study. Achieving this may offer greater insights into the hearing health perceptions and HPD use habits of Christchurch tradespeople, and may account for more variance in the sample, if there is any.

Future research should aim to obtain a larger sample size. Covering a larger portion of the sample size may offer further insight into HPD use among tradespeople in Christchurch. Future research could increase the sample size in a stratified way so there are different variables among participants, offering a more accurate insight into HPD use among tradespeople in Christchurch.

Future research should include measurements of the amount of time that tradespeople are exposed to occupational environmental noise. These measures could be performed using a

noise dosimeter. Monitoring HPD use of participants as observed phenomenon may result greater accuracy surrounding HPD use in an occupational setting in future research. This may be achieved by going to trade sites, observing and recording the amount of time participants are using HPDs. Methods that are less retrospective than self-reporting, such as having the participants record the number of hours spent using HPDs/hours exposed to noise at the end of each day, could be used to improve accuracy of duration of noise exposure and HPD use.

The researcher would suggest changing the question surrounding how long participants spend in non-occupational noise. The question in the survey asks “how often do you wear hearing protection when you are doing noisy activities when you are not at work? (average hours)” In future studies, this question could be adapted to specify the average hours per day participants are involved in noisy activities in a non-occupational setting.

Interviewing a focus group made up of the intended population of this current study and asking them how they would word the question may be another way of improving it.

Similarly, to recording how many hours spent in noise at work, participants could be instructed to record how long they spent doing noisy activities outside of work at the end of each day. However, there is a large variety of noisy activities (e.g. concert attendance, power tool use, firearms exposure) that an individual can be involved in in a non-occupational setting (Neitzel et al., 2004). It was soon discovered by the researcher of this current study that a separate study would be required to fully investigate the relationship between the constructs of the HBM and HPD use in non-occupational settings as a consequence of the variety and the infrequent nature of many non-occupational activities.

Future research should try and aim to account for any external factors mentioned previously. Investigating the external factors, as well as the perceived factors will provide greater insight into what influences HPD use among Christchurch tradespeople in an occupational setting.

This current study did not investigate the amount of education and training Christchurch tradespeople receive. Nodushan et al. (2014) suggest that proper education and training surrounding the effective use of HPDs may reduce the individual's overall exposure to hazardous noise. Future studies could include an investigation into the education and training of Christchurch tradespeople to offer insight into how effectively they are utilising HPDs in noisy environments. The perceptions and individual may have towards HPDs may vary depending on their level of training and education surrounding the devices.

Future study should revise the adapted HBQ. It may have been a possibility that the way in which the items of the adapted HBQ were worded, was not the way which suited the intended population. A revision of the adapted HBQ may result in editing, adding, or removing items from the current survey. A focus group of the intended population may offer insight into ways in which items of the adapted HBQ should be worded to suit tradespeople.

There are still multiple construction and building projects of various sizes under operation in Christchurch despite predictions that construction and building would peak in 2016 (The National Construction Pipeline Report, 2015). Consequently, there is still emphasis on the need for future research to identify factors which influence HPD use in order to implicate effective use of HPDs to supplement the abatement of potentially damaging environmental noise that tradespeople in Christchurch are exposed to. In conclusion, the results of this current study revealed that the adapted HBQ could not be used to investigate the relationship between the constructs of the HBM and HPD use among Christchurch tradespeople in occupational and non-occupational settings.

Appendix

Appendix 1: Ethics Approval Letter



HUMAN ETHICS COMMITTEE

Secretary, Rebecca Robinson
Telephone: +64 03 369 4588, Extn 94588
Email: human-ethics@canterbury.ac.nz

Ref: HEC 2017/24/LR

9 May 2017

Andrew Cornford
Communication Disorders
UNIVERSITY OF CANTERBURY

Dear Andrew

Thank you for submitting your low risk application to the Human Ethics Committee for the research proposal titled "The relationship between the constructs of the health belief model (HBM) and hearing protection use among Christchurch construction workers in occupational and non-occupational settings".

I am pleased to advise that this application has been reviewed and approved.

With best wishes for your project.

Yours sincerely

R. Robinson
pp.

Associate Professor Jane Maidment
Chair, Human Ethics Committee

Appendix 2: Adapted HBQ

Part 1:

Please state your gender:

- Male
- Female
- Other

What is your current age? (In years).

What is your current job title? (E.g. Builder, Project Manager)

Have you had your hearing tested in the last 2 years?

- Yes
- No

Do you have a hearing loss?

- Yes
- No
- Don't know

In a normal workday, how many hours are you exposed to noise? (Please state average hours)

Options ranging from 0-8+hrs

Do you have access to hearing protectors at work? (Ear-muffs, ear-plugs, custom ear-plugs)

- Yes
- No
- Don't know

How often do you wear hearing protection at work? (Please state average hours)

Options ranging from 0-8+hrs

Do you have a hearing protector at home? (Ear-muffs, ear-plugs, custom ear-plugs)

- Yes
- No
- Don't know

How often do you wear hearing protection when you are doing noisy activities when you are not at work? (Please state average hours)

Options range from 0-8+hrs

Part 2:

Instructions: For these following items, please choose a point along the scale of 0 (completely disagree) to 10 (completely agree) that best matches your view for each statement below.

10-point scale:

0 = Completely disagree

5 = No Opinion

10 = Completely agree

Perceived Susceptibility questions

- Q1 My hearing will likely get worse in the future.
- Q2 It is possible that I will lose my hearing.
- Q3 *I am not likely to lose my hearing because hearing loss doesn't run in my family.
- Q4 I've heard you should get your hearing tested now and then.

Perceived Severity questions

- Q5 Having a hearing loss would limit my daily activities
- Q6 When people have hearing loss, their relationships with family and friends suffer.
- Q7 Having a hearing loss negatively impacts a person's job performance.

Perceived Benefits questions

- Q8 The benefits of using hearing protection devices would outweigh the costs.
- Q9 I would worry if I had a hearing loss.
- Q10 *I don't go out much so having a hearing loss wouldn't be a big problem for me.
- Q11 If I had a hearing loss, I would worry about missing important information during visits with my doctor.
- Q12 It would be stressful to have a hearing loss.

Perceived Barriers questions

- Q13 I am too young to have a hearing loss.
- Q14 It is uncomfortable wearing hearing protection devices (ear-muffs and ear-plugs included).
- Q15 Hearing protection devices aren't worth the trouble.
- Q16 Hearing protection devices are ugly.
- Q17 Most people say hearing protection devices don't work well.
- Q18 I usually notice when someone is wearing hearing protection.

Cues to Action questions

- Q19 I have heard good things about hearing protection devices.
- Q20 I know where to get hearing protection devices at work if I needed them.
- Q21 I know where to get hearing protection devices outside of work if I needed them.
- Q22 My work place encourages the use of hearing protection devices.

Perceived self-efficacy

- Q23 *Once you have a hearing loss there's not much you can do about it.
- Q24 *It would be difficult to use hearing protection devices at work.
- Q25 *It would be difficult to use hearing protection devices outside of work.
- Q26 Hearing protection devices are easy to lose.

*Item is reverse scored

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